IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Cai Application No.: 10/784757 Filed: 02/23/2004 Title: PIM Designated Router Functioning on Behalf of Local IGMP Hosts in Multi-Access Network Attorney Docket No.: 120-334	Group Art Unit: 2153 Examiner: Phan

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APPELLANT'S BRIEF PURSUANT TO 37 C.F.R. § 1.192

Please enter this brief in accordance with the contemporaneously filed Notice of Appeal.

I. Real Party in Interest

The real party in interest is Nortel Networks, Limited.

II. Related Appeals and Interferences

Appellants are not aware of any appeals or interferences that are related to the present application.

III. Status of the Claims

Claims 1-16 are pending in this application. All of the pending claims are rejected. Claims 2-5, 8 and 11-15 are original. Claims 1, 6, 7, 9, 10, and 16 are previously presented. Claims 1-16 are the subject of this appeal.

IV. Status of Amendments

An amendment was filed January 17, 2008. That Amendment was entered and considered.

V. Summary of Claimed Subject Matter

The subject matter of the invention is maintaining consistent group membership data at a Designated Router executing the Protocol Independent Multicast (PIM) protocol. Support for the recited claim limitations is in the specification and drawing as indicated below next to the claim limitations.

1. A method of maintaining consistent group membership data at a Designated Router executing the Protocol Independent Multicast (PIM) protocol **(page 7, lines 2-4)** including the steps of:

receiving, at the Designated Router, an IGMP membership message from an IGMP host operating according to the Internet Group Multicast Protocol (IGMP) protocol; **("for the purposes of this invention, the DR includes logic to appropriately process IGMP Report and Leave messages" at page 7, lines 11-12; "At step 100, the DR receives an IGMP Report on network interface A" at page 9, line 21)**

translating the IGMP membership message into a PIM membership message; **("If the interfaces match, interface A the same interface as interface B, and hence the IGMP report is forwarded from an upstream device, and the DR is in the downstream path ... the DR should translate the IGMP Report to a PIM Join" at page 10, lines 3-7, and step 106, Figure 3)** and

selectively forwarding the PIM membership message to a device upstream from the Designated Router, **("the DR should ... forward the Join to the upstream neighbor" at page 10, lines 3-7, and step 108, Figure 3)**

including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host. **("Referring back to Figure 4, if, however, at step 130 it is determined that the DR is in the upstream path from the IGMP Host, then the Leave should potentially cause the PIM entry to be deleted.**

However, there may be other devices that are on the local network with the IGMP Host which are members of the multicast group, and thus the PIM entry should not be deleted. In such an embodiment, the DR sets the output interface (oif) delete timer for interface A to a predetermined time (for example, five seconds). This action will cause PIM entry to be deleted at the end of the time interval unless a Join stops the deletion. The DR forwards PIM Prune back over the interface on which the IGMP Leave was received (Interface A). Other devices on the network which see the PIM prune but have an active PIM entry for the (s, g) pair immediately forward a PIM Join to the DR, causing the oif delete time to be reset." at page 12, lines 8-18)

6. A method of maintaining consistent group membership data at a Designated Router executing the Protocol Independent Multicast (PIM) protocol **(page 7, lines 2-4)** including the steps of:

receiving, at the Designated Router, an IGMP membership message from an IGMP Host device operating according to the Internet Group Multicast Protocol (IGMP) protocol; **("for the purposes of this invention, the DR includes logic to appropriately process IGMP Report and Leave messages" at page 7, lines 11-12; "At step 100, the DR receives an IGMP Report on network interface A" at page 9, line 21)**

determining whether an entry in a PIM routing table corresponds to information in the IGMP membership message;

translating the IGMP membership message into a PIM membership message; **("If the interfaces match, interface A the same interface as interface B, and hence the IGMP report is forwarded from an upstream device, and the DR is in the downstream path ... the DR should translate the IGMP Report to a PIM Join" at page 10, lines 3-7, and step 106, Figure 3)** and

selectively forwarding the PIM membership message to a device upstream from the Designated Router, **("the DR should ... forward the Join to the upstream neighbor" at page 10, lines 3-7, and step 108, Figure 3)**

including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host. **("Referring back to Figure 4, if, however, at step 130 it is determined that the DR is in the upstream path from the IGMP Host, then the Leave should potentially cause the PIM entry to be deleted. However, there may be other devices that are on the local network with the IGMP Host which are members of the multicast group, and thus the PIM entry should not be deleted. In such an embodiment, the DR sets the output interface (oif) delete timer for interface A to a predetermined time (for example, five seconds). This action will cause PIM entry to be deleted at the end of the time interval unless a Join stops the deletion. The DR forwards PIM Prune back over the interface on which the IGMP Leave was received (Interface A). Other devices on the network which see the PIM prune but have an active PIM entry for the (s, g) pair**

immediately forward a PIM Join to the DR, causing the oif delete time to be reset." at page 12, lines 8-18)

10. A method of maintaining consistent group membership data at a Router executing the Protocol Independent Multicast (PIM) protocol **(page 7, lines 2-4)** including the steps of:

receiving a PIM membership message on a first interface, the membership message identifying a (source, group) pair; **("for the purposes of this invention, the DR includes logic to appropriately process IGMP Report and Leave messages" at page 7, lines 11-12; "At step 100, the DR receives an IGMP Report on network interface A" at page 9, line 21)**

searching a multicast routing table to determine whether an entry corresponding to the (source, group) pair and associated with a coupled IGMP Host is stored in the multicast routing table; **("At step 106, the multicast routing table is searched to determine whether there is a PIM entry corresponding to the Interface A (s, g) pair of the IGMP Leave message." at page 11, lines 9-11)**

and

selectively processing the PIM membership message responsive to whether the entry is stored in the routing table, **("If no entry exists, then at step 126 it is determined whether the DR is upstream from the IGMP Host issuing the Leave by comparing the value of Interface A with Interface B. If DR is in the downstream path, (A=B) , then the DR issues**

a PIM Prune to the upstream neighbor on interface A. The process is then complete. Alternatively, if there was no entry (at step 124) and at step 126 it is determined that the DR is in the upstream path, no action is taken, as the DR already had the PIM entry pruned by other means." at page 11, lines 11-17)

including not processing a PIM prune message if a local IGMP host exists. **("In Figure 5, at step 140 assume a PIM Prune is received at interface A of a multicast router. Thus, at step 142 it is determined whether there is local IGMP (s,g) pair on interface A, and thus whether a PIM entry is stored for the pair. At step 142, it is determined whether the router is the intended recipient of the PIM Prune. If it is the recipient, the router knows that it does not want to prune, due to the existence of the local IGMP Host. Thus, at step 148 the router ignores the prune. Otherwise, if the router is not the source of the PIM Prune, it issues a Join to the upstream neighbor to override the Prune and maintain the communication path with the local IGMP Host." at page 13, lines 11-18)**

16. A router comprising:

a routing table, the routing table including at least two entries including information for forwarding PIM multicast messages; **("According to one embodiment of the invention, the multicast routing table includes Protocol Independent Multicast (PIM) entries, such as entry 33. A route**

entry is a state maintained in a router along the distribution tree and is created and updated based on incoming control messages. In particular, each PIM multicast routing entry includes source specific route entries, identifying a source of a multicast group message, and a group to which the multicast message is to be distributed. Generally the route entry specifies at least one incoming interface (iif), and at least one outgoing interface (oif). The incoming interface indicates the interface from which multicast data packets are accepted for forwarding, and is initialized when the entry is created. The outgoing interface(s) are those interfaces over which outgoing multicast messages for the (source, group) [(s,g)] pair should be forwarded." at page 8, lines 6-16)

a network interface for receiving messages from a neighboring device, the messages including IGMP Host messages; **("As shown in Figure 2, the DR includes a number of interfaces, including a Local Area Network (LAN) interface 22 and a Wide Area Network (WAN) interface 24. Although only one LAN interface port 22 and WAN interface port 24, it is understood that routers typically include multiple interface ports, for connecting to multiple different networks, and the router includes logic for appropriately forwarding commands and data to the devices on the various networks via the interface ports. LAN interface logic 28 and WAN interface logic 26 control the flow of data between router control functionality and the interface ports." at page 7, lines 13-20; and "for the purposes of this invention, the DR includes logic to appropriately process**

IGMP Report and Leave messages" at page 7, lines 11-12; and "At step 100, the DR receives an IGMP Report on network interface A" at page 9, line 21)

translation logic for converting IGMP Host messages received from the network interface to PIM messages; **("The DR of the present invention is shown to include Conversion Logic 32, Route Table Controller 34 and a Multicast routing table 36. The Conversion Logic operates to selectively translate received IGMP group membership commands into PIM group membership commands, where 'group membership' commands include any messages that control the addition, deletion or modification of membership information for a given group" at page 7, line 21 through page 8, line 3; and "If the interfaces match, interface A the same interface as interface B, and hence the IGMP report is forwarded from an upstream device, and the DR is in the downstream path ... the DR should translate the IGMP Report to a PIM Join" at page 10, lines 3-7, and step 106, Figure 3)** and

forwarding logic for selectively forwarding the translated PIM messages to neighboring upstream devices, **("the DR should ... forward the Join to the upstream neighbor" at page 10, lines 3-7, and step 108, Figure 3)**

including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host. **("Referring back to Figure 4, if, however, at step 130 it is determined that the DR is in the upstream path from the IGMP Host,**

then the Leave should potentially cause the PIM entry to be deleted. However, there may be other devices that are on the local network with the IGMP Host which are members of the multicast group, and thus the PIM entry should not be deleted. In such an embodiment, the DR sets the output interface (oif) delete timer for interface A to a predetermined time (for example, five seconds). This action will cause PIM entry to be deleted at the end of the time interval unless a Join stops the deletion. The DR forwards PIM Prune back over the interface on which the IGMP Leave was received (Interface A). Other devices on the network which see the PIM prune but have an active PIM entry for the (s, g) pair immediately forward a PIM Join to the DR, causing the oif delete time to be reset." at page 12, lines 8-18)

VI. Grounds of Rejection to be Reviewed on Appeal

A. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watkinson in view of Haggerty.

B. Claim 10 is rejected under 35 U.S.C. 112, second paragraph.

VII. Argument

A. Claims 1 through 9 and 16 distinguish the cited combination because forwarding a PIM prune message in response to an IGMP Leave is delayed if the Designated Router is in the upstream path from the IGMP host.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). The Office has failed to establish *prima facie* obviousness of a claimed invention because the cited combination fails to teach or suggest that forwarding a PIM prune message in response to an IGMP Leave is delayed if the Designated Router is in the upstream path from the IGMP host.

A potential problem occurs when the designated router is upstream from the IGMP host because there may be other members of the multicast group on the local network. In particular, an IGMP Leave could potentially cause the PIM entry to be deleted from the routing table even though those other devices are on the local network with the IGMP Host, i.e., devices which are still members of the multicast group. The limitations recited in claims 1, 6 and 16 helps avoid this problem because the presence of such other members can be indicated by a Join received during the delay. The Office asserts that this feature is shown in Haggerty at column 19, lines 40 and 58. However, the cited passages describes

both a different problem and a different solution. In particular, Haggerty describes delaying **queries** on access ports having active senders as a technique for reducing the IGMP Active Senders problem. As stated at column 19, lines 25-32 and lines 35-36, a query is a request for an IGMP membership report, i.e., a request for Joins. The limitation recited in claims 1, 6 and 16 is not delaying a **query**, but rather delaying **forwarding a PIM prune message** in response to an **IGMP Leave** if the Designated Router is in the upstream path from the IGMP host. Although the cited passage teaches a timer, that timer determines the time during which reports must be received, rather than when a PIM prune message is sent. Consequently, the cited passage fails to show even one of the following inter-related claim limitations: (1) an IGMP Leave, (2) the Designated Router is in the upstream path from the IGMP host, and (3) delaying forwarding a PIM prune message. The Office cannot simply read these details into the reference based on the presence of a timer. The law requires that the limitations must be taught or suggested by the reference. Therefore, the Office has failed to establish *prima facie* obviousness.

Claims 2-5 and 7-9 are dependent claims which further distinguish the claimed invention, and which are allowable for the same reasons as their respective base claims. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

B. Claims 10 through 15 distinguish the cited combination by reciting not processing a PIM prune message if a local IGMP host exists.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). The Office has failed to establish *prima facie* obviousness of a claimed invention because the cited combination fails to teach or suggest not processing a PIM prune message if a local IGMP host exists.

Claim 10 recites a further method for enhancing PIM Prune handling. In particular, claims 1 through 9 and 16 recite **delaying** forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host, and claim 10 recites **not processing** a PIM prune message if a local IGMP host exists. The Office asserts that this feature is shown in Haggerty at column 19, lines 40 and 58. However, the cited passages describes both a different problem and a different solution. In particular, Haggerty describes delaying queries on access ports having active senders as a technique for reducing the IGMP Active Senders problem. As stated at column 19, lines 25-32 and lines 35-36, a query is a request for an IGMP membership report, i.e., a request for Joins. The recited limitation is not delaying a query, but rather **not processing a PIM prune message** if a local IGMP host exists. The

cited passage fails to show even one of the following inter-related claim limitations: (1) not processing a PIM prune message, and (2) if a local IGMP host exists. The Office cannot simply read these details into the reference. The limitations must be taught or suggested by the reference. Therefore, the Office has failed to establish *prima facie* obviousness.

Claims 11-15 are dependent claims which further distinguish the claimed invention, and which are allowable for the same reasons as their respective base claims. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

C. The negative limitation "not processing" recited in claim 10 does not render the claim indefinite.

The MPEP provides the following examples of claim indefiniteness: terminology inconsistent with accepted meaning; relative terms; broad and narrow range limitation in same claim; lack of antecedent basis; literal translation; means lacking function, omission of essential steps or relationships; and the introductory phrases "or the like," "such as," and "for example." There is no rule that a negative limitation renders a claim indefinite. Further, this particular negative limitation is logically as definite as a corresponding positive limitation. In other words, when a device receives an instruction, the device can either execute the

instruction or not execute the instruction. In either case, the result is clear and definite. Because the Office fails to provide either clear grounds in the law for the rejection or a logical argument why the rejection is even based on the spirit of the law, the rejection is improper.

VIII. Conclusion

Appellants submit therefore that the rejections of the present claims are improper for at least the reasons set forth above. Appellants accordingly request that the rejections be withdrawn and the case put forward for allowance.

Respectfully submitted,

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Appendix A - Claims

1. (previously presented) A method of maintaining consistent group membership data at a Designated Router executing the Protocol Independent Multicast (PIM) protocol including the steps of:

receiving, at the Designated Router, an IGMP membership message from an IGMP host operating according to the Internet Group Multicast Protocol (IGMP) protocol;

translating the IGMP membership message into a PIM membership message; and

selectively forwarding the PIM membership message to a device upstream from the Designated Router, including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host.

2. (original) The method according to claim 1, wherein the step of selectively forwarding further includes the steps of:

determining whether the designated router is upstream from the host device; and

responsive to a determination that the designated router is upstream from the host device, modifying an entry in a PIM routing table associated with the IGMP host responsive to the IGMP membership message.

3. (original) The method according to claim 2, wherein the IGMP membership message indicates that a member is joining a multicast group, and the step of modifying includes the step of generating and storing a PIM entry in a multicast routing table responsive to information in the IGMP membership message.

4. (original) The method of claim 1, wherein the IGMP membership message is a Report message, including an identifier and network interface for a member of a group, and where the step of translating translates the Report message into a PIM Join message.

5. (original) The method of claim 1, wherein the IGMP membership message is a Leave message, indicating an identifier and network interface for a member leaving a group, and wherein the step of translating converts the Leave message to a PIM Prune message.

6. (previously presented) A method of maintaining consistent group membership data at a Designated Router executing the Protocol Independent Multicast (PIM) protocol including the steps of:

receiving, at the Designated Router, an IGMP membership message from an IGMP Host device operating according to the Internet Group Multicast Protocol (IGMP) protocol;

determining whether an entry in a PIM routing table corresponds to information in the IGMP membership message;

translating the IGMP membership message into a PIM membership message; and

selectively forwarding the PIM membership message to a device upstream from the Designated Router, including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host.

7. (previously presented) The method of claim 6, wherein the step of selectively forwarding the PIM membership message operates in response to whether the entry exists in the routing table and in response to whether the designated router is upstream from the IGMP Host device.

8. (original) The method of claim 7, wherein the IGMP protocol message indicates that a member is leaving a group, and wherein the PIM membership message indicates removal of the member from the group, and wherein the method further includes the step of delaying removal of the member from the group at the designated router for a predetermined time period.

9. (previously presented) The method according to claim 6, wherein the designate router forwards the PIM membership message on the network interface on which the IGMP membership message is received.

10. (previously presented) A method of maintaining consistent group membership data at a Router executing the Protocol Independent Multicast (PIM) protocol including the steps of:

receiving a PIM membership message on a first interface, the membership message identifying a (source, group) pair;

searching a multicast routing table to determine whether an entry corresponding to the (source, group) pair and associated with a coupled IGMP Host is stored in the multicast routing table; and

selectively processing the PIM membership message responsive to whether the entry is stored in the routing table, including not processing a PIM prune message if a local IGMP host exists.

11. (original) The method according to claim 10, further responsive to whether the PIM membership message is addressed to the Router.

12. (original) The method according to claim 11, further including the step of only forwarding the PIM membership message if the PIM message is addressed to the Router and an entry is stored in the routing table.

13. (original) The method according to claim 10, further including the step of determining whether the IGMP Host is downstream from the Router.

14. (original) The method according to claim 10, further including the step of suppressing forwarding of the PIM membership message in response to the entry being stored in the routing table and the IGMP Host not being downstream from the Router.

15. (original) The method according to claim 10, further including the step of forwarding of the PIM membership message in response to the entry being stored in the routing table and the IGMP Host being downstream from the Router.

16. (previously presented) A router comprising:

a routing table, the routing table including at least two entries including information for forwarding PIM multicast messages;

a network interface for receiving messages from a neighboring device, the messages including IGMP Host messages;

translation logic for converting IGMP Host messages received from the network interface to PIM messages; and

forwarding logic for selectively forwarding the translated PIM messages to neighboring upstream devices, including delaying forwarding a PIM prune message in response to an IGMP Leave if the Designated Router is in the upstream path from the IGMP host.

Appendix B - Evidence Submitted

None.

Appendix C - Related Proceedings

None.